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(54)	AUTOMATIC TELEPHONE EXCHANGES	(57)	Abstract:
(54)	SYSTEME AUTOMATIQUE DE CENTRAL TELEPHONIQUE		

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The present invention relates to coding devices suitable for use in an automatic exchange as described in the specification of co-pending Canadian Patent Application Serial No. 620,032, filed September 4, 1951, in the names of A.A. Chubb and M.M. Levy and entitled Telecommunication Systems Embodying Automatic Exchanges.

10 In the automatic exchange described in the aforesaid co-pending patent application a plurality of communication channels are provided, and in response to a calling signal from a calling subscriber a free one of these channels is selected. In response to dialling signals the called subscriber is called and the identification of the selected free channel is transmitted to the called subscriber's terminal equipment. In order to achieve this a routeing device is used and may be as described in the specification of co-pending Canadian Patent
20 Application Serial No. 620,038, filed September 4, 1951, in the name of M.M. Levy and entitled Switching Devices. This routeing device requires a set of two or more control signals of predetermined characteristic to be applied to its input terminal in order to establish a connection with one of its output terminals.

An object of the present invention is to provide a coding device suitable for storing dialling signals from

a calling subscriber, converting these signals into a set of control signals suitable for application to the aforesaid routeing device, and in addition giving the control signals a characteristic identified with the aforesaid selected free channel.

According to the present invention a coding device comprises two or more selector switching devices, each having a plurality of input terminals, an output terminal, and being adapted, in response to different dialling signals to connect different ones of the input terminals to the output terminal, means for applying control voltages of different, predetermined characteristics to the input terminals respectively of the selector switching devices, means for combining the control voltages appearing at the output terminals of the several selector switching devices to form a set, and means for adding a further characteristic to the set of control voltages. Where the several channels in the automatic exchange described in the first named co-pending application are constituted by interlaced pulse trains, the means for adding the further

characteristic to the combined control voltages may comprise a gate device to which the combined control voltages are applied. Pulses in the selected free channel may be applied to the gate device to open the gate recurrently whereby the combined control voltages appear at the output of the gate only during each pulse in the selected channel. The means for adding the further characteristic
10 may comprise means for combining further voltages with the set, the further voltages having characteristics independent of those in the set. For example the further voltages may be representative of the aforesaid selected free channel.

The control voltages may be, for example, pulses of different instants of occurrence, or oscillations of different frequencies.

20 The dialling impulses representing the different digits dialled may be applied to set different ones of the selector switching devices in known manner, and a further switch device may be arranged to prevent the output from at least the last selector switching device

to be set, from reaching the output of the coding device.

The invention will now be described by way of example with reference to the accompanying drawings, in which

Figure 1 is a circuit diagram of one embodiment of the invention, and

Figures 2 and 3 are explanatory diagrams.

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The "detached contact" system of references is used in Figure 1, this system being as described on page 9 of British Standard 530:1948 Graphical Symbols for Telecommunications published by the British Standards Institution. In this system, symbols for parts of components, for example relay coils and contacts, are not placed together, but are placed in positions in the diagram relating to their functional applications. A relay is given a reference in the form of a fraction in which the numerator is a letter and is the relay reference and the denominator is a number indicating the number of sets of contacts on the relay. For example a relay winding may have the reference $\frac{A}{3}$ indicating that

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the relay X has three contacts. These would be referenced X1, X2 and X3.

Referring to Figure 1, a dial DL of an automatic telephone set (not shown) is connected in series with a relay coil A and a battery BAT_1 . Thus operation of the dial DL causes a series of pulses of current to flow through the relay coil A at the standard frequency of 10 p.p.s. It will be assumed that the number dialled has four digits, say 1, 2, 3, 4 respectively.

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The pulses of current in the relay coil A cause operation of the contacts A1 at the same rate. These contacts are connected to the wiper of a bank Z1 of a uniselector Z, and the wiper of the bank Z1 is normally on its first contact.

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This first contact is connected through the winding of a second uniselector M and a battery BAT_2 to earth. Thus successive operations of the contacts A1 causes the wipers of the uniselector M to be stepped around their bank contacts. The uniselectors and stepping action thereof may be as described in Chapter 3 of "Telephony" Vol. II by J. Atkinson

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The bank M1 of the unselector M has eleven bank contacts, the first of which is a "home" contact. The remaining ten bank contacts of M1 are connected to ten terminals MP₁ to MP₉ and MP₀ respectively. Thus in the present example in which the first digit is 1 the wiper of the bank M1 is connected to the terminal MP₁.

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A slow acting relay B has one terminal of its operating coil connected to the contacts A1 and the other through a battery BAT₃ to earth. The relay is arranged to "hold" between adjacent impulses in each digit dialled and hence becomes operated and released once for each digit dialled.

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The contacts B1 of the relay B complete a circuit from earth through the winding of the unselector Z and a battery BAT₄ back to earth. Thus the wipers of the unselector Z make one forward step after each digit is dialled. Thus when the second digit (2 in this example) is dialled, the wiper of the bank Z1 is on its second bank contact. This is connected through the operating winding of a unselector C and thence through a battery BAT₅ to earth.

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The bank C1 of the unselector C has eleven bank contacts of which the first is an isolated home contact. The remaining ten bank contacts are connected to terminals CP_1 to CP_9 and CP_0 respectively. In this example, therefore, the wiper of the bank C1 becomes connected to the terminal CP_2 .

10 The relay B steps the wiper of the unselector bank Z1 on to its third contact before the third digit is dialled. The third contact of Z1 is connected through the operating winding of a unselector D and thence through a battery BAT_6 to earth.

20 The bank D1 of the unselector D has eleven bank contacts of which the first is an isolated home contact. The remaining ten bank contacts are connected to ten terminals DP_1 to DP_9 and DP_0 respectively. Thus in this example, the wiper of the bank D1 becomes connected to the terminal DP_3 .

At the end of the third digit the relay B steps the wiper of the unselector Z on to its fourth contact. The fourth contact is connected to the

operating winding of a uniselector U and thence through a battery BAT₇ to earth.

The bank U₁ of the uniselector U has eleven bank contacts of which the first is an isolated home contact. The remaining ten bank contacts are connected to ten terminals UP₁ to UP₉ and UP₀ respectively. Thus in this example the wiper of the bank U₁ becomes connected to the terminal UP₄.

- 10 The 40 terminals UP₁ through to MP₀ are connected by suitable connectors (not shown) to the 40 output terminals of like reference respectively of a main pulse generator MPG. This pulse generator is arranged in any suitable manner to generate a recurring sequence of 40 pulses which appear at the 40 terminals MP₀ to UP₉ respectively. The pulse generator may be as described in the specification of the
- 20 aforementioned co-pending Canadian Patent Application Serial No. 620,032. The generated pulses will be referred to by the letters M, C, D and U followed by a subscript corresponding to the subscripts in the references to the terminals at which the pulses appear. Thus in the present example pulses M₁, C₂, D₃ and U₄ appear

at the wipers of the four unselector banks M1, C1, D1 and U1 respectively. This set of pulses is regularly recurring as indicated in Figure 2(a).

The pulses of each set are combined through four rectifiers W_1 to W_4 respectively and applied through a resistor R and relay contacts Q2 to an output terminal OT.

10 An auxiliary pulse generator APG is connected through a rectifier W_5 to the end of the resistor R remote from the rectifiers W_1 to W_4 . This pulse generator is arranged to generate relatively broad pulses of a width equal to that of a complete sequence of M, C, D and U pulses, and at a recurrence frequency equal to one fifth of that of the sets of M, C, D and U pulses. Thus the waveform of the pulses provided by the auxiliary pulse generator is as shown at GP in
20 Figure 2(b).

In the absence of pulses from the auxiliary generator APG the rectifier W_5 is conducting and hence the sets of pulses from the unselector banks M1, C1, D1 and U1 are dropped across R. When a pulse appears at the output of the pulse

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generator APG, however, the rectifier W_5 becomes non-conducting and permits pulses to pass from the unselector banks to the contacts Q2. Thus in the present example only every fifth set of M_1 , C_2 , D_3 and U_4 pulses are passed to the contacts Q2.

Referring again to the unselector

bank Z1, after the last digit has been dialled the relay B steps the wiper of Z1 on to its fifth contact and hence causes energisation of a relay coil Q from a battery BAT_g. Thus when, and not until, the wipers of all four uniselector banks M1, C1, D1 and U1 have been set in accordance with the number dialled, the relay contacts Q2 close and the sets of M₁C₂D₃ and U₄ pulses gated by the auxiliary generator APG appear at the output terminal OT.

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The contacts Q1 "hold" the relay Q through a switch S₁ which is closed before the apparatus is put into use. The switch S₁ may, of course, conveniently be contacts of a further relay (not shown).

The uniselector banks M2, C2, D2, U2 and Z2 are homing banks and may operate as described on pages 259 and 260 of Telephony Volume II by Atkinson. Thus in order to switch off the apparatus switches S₂ to S₆ which may also conveniently be contacts of a relay (not shown) are closed to cause all uniselectors to home, and S₁ is opened to de-energise the relay Q and hence to open the contacts Q2.

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In a second embodiment the output of the auxiliary pulse generator APG^G is of different form, the resistor R is removed and the rectifier W₅

reversed. The pulse generator APG is arranged to generate pulses which occur after the last U pulse in each set and before the M pulse in the next succeeding set.

For example referring to Figure 3 this shows a set of M_1 , C_2 , D_3 and U_4 pulses on a larger scale than in Figure 2. After the U_4 pulse and before the next succeeding M_1 pulses two further pulses d_5 and u_3 are added.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Coding apparatus for automatic exchanges, comprising a main input terminal to receive dialling impulses, a plurality of selector switching devices each having a plurality of input terminals and an output terminal, control apparatus to actuate said selector switching devices in response to dialling impulses, means to apply dialling impulses from said main input terminal to said control apparatus to select different ones of the said input terminals of said selector switching devices for connection to said output terminals thereof respectively, a source of voltages of different characteristics, means to apply said voltages to the input terminals of said selector switching devices, different voltages being applied to different ones of the last said terminals, a combining circuit connecting the output terminals of said selector switching devices to provide a combined output from said selector switching devices, a source of signalling voltage, means for combining a signal voltage from the last named source with said combined output, a main output terminal and means applying the signal voltage combined with the combined output to said main output terminal whereby to produce at said main output terminal a signal having characteristics related to said dialling impulses and to a signal from the last named source.

2. Coding apparatus for automatic exchanges, comprising a main input terminal to receive dialling impulses, a plurality of selector switching devices each having a plurality of input terminals and an output terminal, control apparatus to actuate said selector switching devices in response to dialling impulses, means to apply dialling impulses from said main input terminal to said control apparatus to select different ones of the said input terminals of said selector switching devices for connection to said output terminals thereof respectively, a source of voltages of different characteristics, means to apply said voltages to the input terminals of said selector switching devices, different voltages being applied to different ones of the last said terminals, a combining circuit connecting the output terminals of said selector switching devices to provide a combined output from said selector switching devices, a source of signalling voltage, a further combining circuit, a main output terminal, means connecting said further combining circuit between the first said combining circuit and said main output terminal, and means to apply signal voltage from the last said source to said further combining circuit to produce at said main output terminal a signal having characteristics related to said dialling impulses and to a signal from the last said source.

3. Coding apparatus according to claim 2, wherein said further combining circuit comprises a gate device through which said combined output from said selector switching devices is applied to said main output terminal and said signal voltage from the last said source is applied to open and close said gate device whereby the voltage at said main output terminal is in the form of a succession of groups of voltages characteristic of said dialling impulses and whose instants of occurrence are characteristic of said signal voltage.

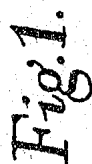
4. Coding apparatus for automatic exchanges, comprising a main input terminal to receive dialling impulses, a plurality a selector switching devices each having a plurality of input terminals and an output terminal, control apparatus to actuate said selector switching devices in response to dialling impulses, means to apply dialling impulses from said main input terminal to said control apparatus to select different ones of the said input terminals of said selector switching devices for connection to said output terminals thereof respectively, means to generate a plurality of interlaced recurring pulses, means to apply different ones of said recurring pulses to different ones of the input terminals of said selector switching devices, a combining circuit connected to the output terminals of said selector switching devices to combine the outputs of said selector switching devices into a

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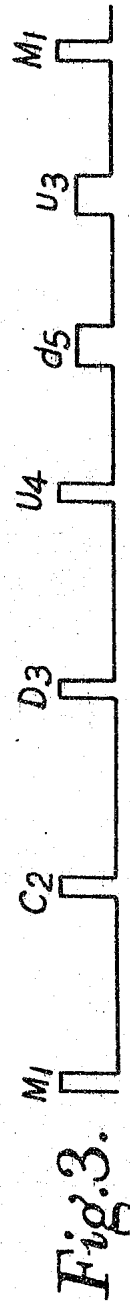
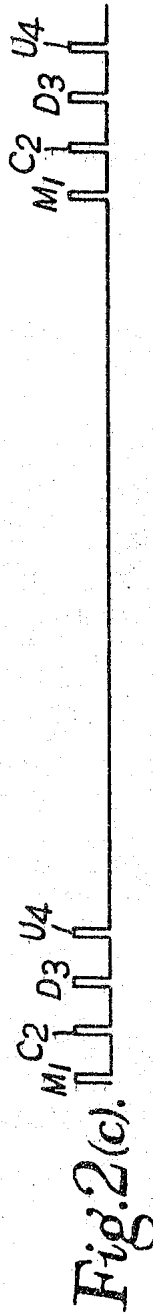
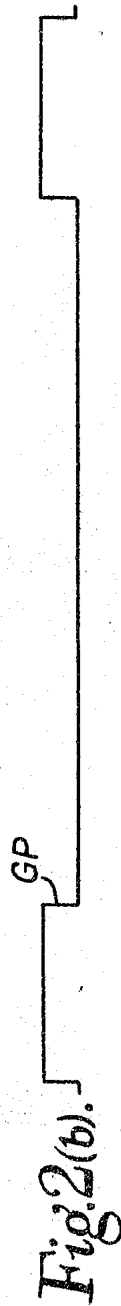
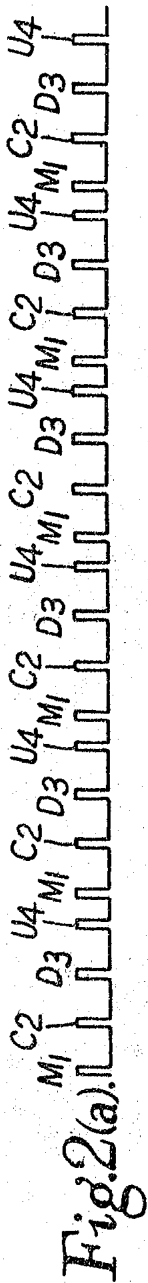
recurring group of pulses characteristic of said dialling impulses, a main output terminal, a gate device, means connecting said gate device between said combining circuit and said main output terminal, a source of signalling pulses, and means to connect said source of signalling pulses to said gate device to open and close said gate device, whereby the voltage appearing at said main output terminal is in the form of a group of pulses characteristic of said dialling impulses and recurring at instants determined by the signalling pulses applied to said gate device from said source of signalling pulses.

5. Coding apparatus for automatic exchanges, comprising a main input terminal to receive dialling impulses, a plurality of selector switching devices each having a plurality of input terminals and an output terminal, control apparatus to actuate said selector switching devices in response to dialling impulses, means to apply dialling impulses from said main input terminal to said control apparatus to select different ones of the said input terminals of said selector switching devices for connection to said output terminals thereof respectively, means to generate a plurality of interlaced recurring pulses, means to apply different ones of said recurring pulses to different ones of the input terminals of said selector switching devices, a combining circuit connected to the output terminals of said selector switching devices to combine the

outputs of said selector switching devices into a recurring group of pulses characteristic of said dialling impulses, a main output terminal, a further combining circuit, means connecting said further combining circuit between the first said combining circuit and said main output terminal, a source of signalling pulses, and means to apply signalling pulses from the last said source to said further combining circuit for combination with said recurring group.



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